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1934

## Power Producing Plants (4th Year): Technical School Examinations 1934

Department of Education: Technical Instruction Branch

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# COURSE IN ELECTRICAL ENGINEERING.

(56)

AN ROINN OIDEACHAIS  
(Department of Education).

BRAINSE AN CHEARD-OIDEACHAIS  
(Technical Instruction Branch).

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TECHNICAL SCHOOL EXAMINATIONS.  
1934.

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## POWER-PRODUCING PLANTS. (Fourth Year.)

*Wednesday, May 30th—6.15 to 8.15 p.m.*

*Examiner—R. G. ALLEN, ESQ., B.SC., A.R.C.S.C.I., M.I.E.E.*

*Co-Examiner—PEADAR A. MACCIONNAITH, M.SC., A.C.S.C.I.*

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### GENERAL INSTRUCTIONS.

You are carefully to enter on the Answer Book and Envelope supplied your Examination Number and the subject of examination, but you are not to write your name on either. No credit will be given for any Answer Book upon which your name is written, or upon which your Examination Number is not written.

You must not have with you any book, notes, or scribbling paper.

You are not allowed to write or make any marks upon your paper of questions.

You must not, under any circumstances whatever, speak to or communicate with another candidate; and no explanation of the subject of the examination may be asked for or given.

You must remain seated until your answer-book has been taken up, and then leave the examination-room quietly. You will not be permitted to leave before the expiration of twenty minutes from the beginning of the examination, and will not be re-admitted after having once left the room.

If you break any of these rules, or use any unfair means, you are liable to be dismissed from the examination, and your examination may be cancelled by the Department.

*Two hours are allowed for this paper. Answer-books, unless previously given up, will be collected at 8.15 p.m.*



## INSTRUCTIONS.

Read the General Instructions on page 1.

- (a) Not more than five questions are to be attempted.
- (b) Equal values are attached to the question.
- (c) Answers must be written in *ink*; diagrams may be made in *pencil*.
- (d) Write the number of the question distinctly, in the margin of your paper, before the answer.

1. Describe the different ways heat may pass from a hot body to a cold body. Give illustrations of this transference. State what factors determine the quantity of heat which flows through a metal plate when a difference of temperature is maintained across its thickness. Also explain the effects of dirt, soot, and gas films in lowering the efficiency of a boiler.

2. Name the different kinds of fuels used in internal combustion engines and give their characteristic qualities. A crude oil engine and dynamo set has an over-all full-load thermal efficiency of 20 per cent. Estimate the cost of the oil to run the set at full load for 50 hours, the horse power of the engine being 30, the calorific value of the oil 19,000 B.T.U. per lb., and the cost of the oil per ton £5.  
(One B.T.U. equal to 778 ft. lbs.)

3. Describe with the aid of sketches the main differences between fire-tube and water-tube boilers. State their relative advantages and disadvantages. A boiler is required to supply 200 lbs. of steam per hour at 80 lbs. per square inch and 100° F. of superheat, and to do this from water at 32° F. requires a total heat of 1,240 B.T.U. per lb. Estimate the horse power capacity of the boiler, neglecting losses, when the temperature of the feed water supplied to it is 140° F.

4. Describe the general construction and explain the operation of one type of Diesel Engine, and point out its special characteristics. In a Diesel engine the calorific value of the fuel used was 18,500 B.T.U. per lb. and the consumption per B.H.P. hour at full load was 0.4 lb. Estimate the over-all thermal efficiency of the engine.

5. Derive a formula for the indicated horse-power per cylinder of a reciprocating engine. Estimate the I.H.P. for a 4 cylinder gas engine in which the mean effective pressure indicated is 90 lbs. per square inch, length of stroke 7 inches, diameter of piston 8 inches, speed 600 R.P.M., and the cycle 4 stroke. If the mechanical efficiency is 84 per cent. find the B.H.P. of the engine.

6. A steam power plant consists of two boilers, two reciprocating engines, and a steam turbine. Make a general lay-out of the plant indicating the main and auxiliary equipment and give a brief account of the function of each auxiliary.

7. Explain why it is generally necessary for prime movers when used for driving electrical machinery to be especially well governed. Describe the construction and explain the operation of either a water turbine governor or a steam turbine governor.

8. Describe one type of apparatus used for obtaining cylinder indicator diagrams. A steam engine fails to give its rated power when running at rated speed. Explain what may be the cause of this and describe how indicator diagrams from the engine may be of use in this diagnosis.

9. Explain with the aid of sketches how the steam consumption per kilowatt-hour of a steam electric plant may be determined experimentally. State what values might be expected for large steam turbines and large steam reciprocating engines.

10. It is required to weld electrically (a) two pieces of straight bar mild steel of cross section 2 by 4 inches; (b) a seam of a cylinder 8 inches in diameter rolled out of 0.25 inch iron plate. Explain, giving sketches of the general features of the outfit used, and state the precautions necessary to produce a good weld.